Workshop on International Climate Services: Understanding and Responding to the Needs of Decision Makers

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Summary Report

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SUMMARY REPORT

I. Overview

A. Introduction and Workshop Rationale

Climate variability and change pose substantial challenges for social, economic and natural systems throughout the world. Climate change and its impacts are an increasingly important component of resource management and planning in key socio-economic sectors, including water resources; agriculture; food security; ecosystem services; coastal planning and management; human health; energy; insurance; disaster prevention, preparedness and response; and national and regional security. Economic and social development strategies increasingly depend upon the capacity to plan for and adjust to climate variability and change. Understanding and meeting these challenges through adaptation, mitigation, and risk management strategies requires a long-term investment in and commitment to sound, multi-disciplinary scientific knowledge, and the enhancement and application of climate services and decision support capabilities that are developed in the context of the practical needs and capabilities of decision makers.

The landscape for international climate services and the use of climate information in critically important decision-making has evolved significantly over the last 20 years, presenting new and more complex challenges for the international community. The demand for useful and forward-looking information about climate variability and change across multiple time scales has substantially expanded during this period, as evidenced by a growing focus on climate and risk management/adaptation in many sectors, countries and regions. Stakeholders and decision makers are requiring a tangible understanding of the impact of changes in climatic conditions on the people and places in which they are vested, and – increasingly – the creation of data, contextual socio-economic information, decision support tools and institutional capacity to reduce the negative consequences, and take advantage of the positive impacts of variability and change. In addition, the last 10-15 years also marks an increasing recognition by institutions with development and resource management mandates, including development (e.g., The World Bank, regional development banks, the World Health Organization) of the need to consider strategic approaches to addressing climate within their relevant sectors.

This demand, and a corresponding evolution of capabilities within the scientific community, has helped drive and shape the creation of research, services, institutions, and networks designed to respond to the desire for *useful*[1] climate information. As a result, the last two decades represents a sort of global "experiment" in the provision and application of climate services within an end-to-end framework that conceptually spans, *inter alia*: climate observations; data management and delivery; climate research and

[1] Workshop participants discussed "useful" climate information is that which is developed and presented in a context and format specific to the problem or management challenge, and capabilities to understand and apply the information.

modeling; multi-disciplinary decision support research and assessments; decision support tool development; training and capacity building; outreach and dialogue among decision makers, scientists and other experts; and ideally, the evaluation and consideration of lessons learned from these activities into the end-to-end process of producing and applying climate information for risk management and adaptation.

Today, the international community is at a critical juncture in the ongoing effort to harness and apply climate science for optimal risk management, adaptation and development. International policy and assessment mechanisms, such as the UN United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC), underscore and call for the need for increased collaboration in the production and use of observations, data, impacts knowledge and related decision support tools and capacity related to both understanding and adapting to a changing climate. In order to help create the technical information, linkages and capacity needed to underpin these and national scale efforts to better understand and utilize information about climate, the 2009 Third World Climate Conference (WCC3) launched the Global Framework for Climate Services initiative that is designed to advance a series of institutional relationships and processes to foster the provision of climate information and predictions for applications in decision-making in climate-sensitive sectors and regions, at timescales ranging from seasons to decades. In parallel, many organizations (including those in the public and private sector), countries, and regions are developing their own strategies and approaches to climate services, which, ideally, would compose the underpinnings and connective tissue of the broader, global climate services effort.

The US is among the countries exploring a more systematic and comprehensive approach to climate services. In terms of its international climate activities, NOAA hopes to i) draw upon the expertise across NOAA and its partners; ii) contribute to global and regional scale efforts to develop and apply climate information for risk management and adaptation; and iii) evolve with the changing needs and capabilities of its constituents and partners.

The convergence of evolving scientific and institutional capabilities on the national and international landscapes provided a natural opportunity (and imperative) for NOAA's Climate Program Office to convene a dialogue with a sub-set number of our partners and stakeholders to thoughtfully explore and consider some of the challenges and opportunities associated with moving into the next phase of international climate services development. Given the scope of the challenge, this workshop was designed to deal specifically with those issues most relevant to understanding and responding to the needs of decision makers, and the potential implications for NOAA's future directions and program investments. It was not intended to cover all dimensions of the development and use of climate information services. This workshop report is the summary of this dialogue and offers some potential directions for NOAA's international climate applications and services development activities.

B. Workshop Objectives and Approach

The purpose of the workshop and summary discussion convened on September 27-29, 2010 in Washington, DC was to generate an enhanced understanding of, and recommendations related to the evolving challenges and opportunities for international climate services efforts, particularly with regards to understanding and responding to user needs. Specifically, the workshop addressed the following objectives:

1. Provide constructive and timely expert input to help shape specific NOAA programmatic/activity investment opportunities in the area of international climate decision support research and services, with an emphasis on understanding and responding to the needs of decision makers; and

2. Help inform international climate strategic planning discussions that address the broader range of international climate research and services from a decision support and user needs perspective.

The two-day workshop featured a series of thematic panels in which invited discussants were asked to give brief, informal presentations, framed by a series of questions that identified key issues for consideration and informed the group discussions that followed each panel. On the third day of the workshop, a small sub-set of the workshop participants (referred to as the Summary Panel) met to reflect upon and distill some of the main ideas and implications of the workshop discussions.

C. Participation

Workshop participants reflected a broad range of multi-disciplinary scientists, technical experts, regions, sectors and international resource management and development organizations with a stake in international decision support research, and the development and sustainability of international climate services in support of risk management and adaptation. These individuals are associated with universities, international intergovernmental institutions, international non-governmental organizations, US and non-US national agencies, and the private sector.

D. Scope and Intended Use of this Workshop Summary Report

This workshop summary is divided into three sections: 1) an overview; 2) a discussion of some of the key challenges and opportunities, with an emphasis on understanding and responding to the needs of decision makers; and 3) an outline of some considerations for NOAA and its partners in implementing future activities. It should be noted that as this report is a summary of a specific workshop, the content is limited largely to the presentations and discussions that took place during the two and a half days of the workshop. It covers perspectives and opinions from individual participants; however, the opinions and interpretations expressed in this report do not necessarily reflect the views of *all* participants or of NOAA. As such, the summary report is not intended to draw

definitive conclusions regarding the nature, role and structure of international climate services, but rather to raise issues and offer some insight for consideration by NOAA and other entities with a role and/or stake in building and sustaining effective science-based international climate services for adaptation, planning and development.

While the focus of this workshop was *international* climate services, many of the challenges and opportunities discussed during the workshop are relevant to climate services in general (e.g., importance of stakeholder involvement from early on, and the co-production of knowledge and decision support tools; challenges related to housing "service-oriented" entities within research institutions beyond the initial demonstration/pilot phase). Thus, this report identifies some concepts and potential approaches that may want to be considered by decision support research and climate service developments on multiple scales, including national and regional.

II. Key Themes: Challenges and Opportunities for International Climate Services

Advances in climate science and capabilities - as well as evolving decision-making needs, policies and institutions - have greatly altered the landscape of climate research and applications over the last decade. Throughout the workshop discussions, several key themes emerged as central to framing and addressing the challenges and opportunities associated with the next generation of international climate services development from the perspective of understanding and responding to the needs of decision makers. The following is a brief summary of several of these key themes discussed during the workshop.

A. Using a Co-Discovery/Co-Development Process to Identify and Respond to User Needs

The suite of societal decisions and policies with a climate dimension is broad and diverse. The related demand for climate information and expertise appears to have grown exponentially in comparison to the development of the institutional and technical capacity to meet this demand. This development is not necessarily negative, however, as an informed "pull" from the user community can help articulate requirements for and further motivate the creation of the scientific and technical understanding, and the institutional relationships and services needed to generate and apply climate information in a particular region or sector on a regular/systematic basis.

The workshop featured a range of perspectives from sectors that have been or are becoming engaged in the international dialogue on climate services (e.g., disaster prevention and recovery, agriculture, food security, human health, coasts, conservation, national security, and long-term development). Although there are some generalized and

transferrable tools and methodologies[2], most workshop participants agreed that the most *useful* information about climate variability and change is that which takes into consideration contextual knowledge and non-climate conditions, including socio-economic elements, and is *co-developed* by scientists and other (non-climate) experts and decision makers through an iterative process of "co-discovery" and "co-development". Such a process focuses on the joint identification of specific resource management problems that can be better informed through the use of climate information, and the co-generation of solutions in the form of decision support tools and strategies. Decision makers articulated a desire for information not only about current or pending climatic conditions, such as a multi-year drought, but also an understanding of how that might affect agriculture, social well-being of vulnerable populations, and migration patterns in a particular region, for example.

This approach of "co-production" by the producers and users of climate information encourages the flow of information in multiple directions (which helps inform science and service directions), develops a shared, "non-jargon" language and understanding, and fosters opportunities for the development of trust and legitimacy among the parties involved. This approach would be essential if climate services were to be envisioned, as suggested by one workshop participant, as providing a "space" where people can explore different futures and scenarios and understand what they would mean for them as far as the implications and trade-offs for socio-economic conditions and natural resources.

Workshop participants also identified the critical function of boundary institutions and bridging functions in this co-generation process – organizational and human "bridges" that could connect the producers and users of information, particularly in cases where information is developed on a global or regional scale and applied at a very local level (examples of this nature discussed at the workshop include disease outbreaks, and disaster preparedness and response). Boundary organizations often include an applied research function in order to translate global or regional scale information into more a more localized (and socio-economically informed) context.

There are various approaches and mechanisms to fulfilling the boundary/bridging function, depending on the needs and capabilities involved. For example, a boundary organization can be *centralized* and work with a suite of partners; the International Research Institute for Climate and Society (IRI) reflects this type of model[3]. Experts with IRI shared their perspectives and some lessons learned regarding their work with decision makers in the iterative fashion described above, and the need to place climate information in a broader context if it is to be useful. An example of a *sector-specific boundary organization* is the Red Cross / Red Crescent Climate Centre, which works to understand the needs of and provide tailored product and dissemination mechanisms for a specific

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[2] Examples include the IRI's Climate Predictability Tool, Map Rooms, Reservoir Management Tool and an Agricultural Decision Making Tool.

[3] A centralized research organization composed of climate scientists and experts from various disciplines, sectors and regions and was discussed in significant detail by the workshop.

management challenge – in this case disaster response and preparedness[4]. It works closely with the IRI as well as with the National Meteorological and Hydrological Services in several regions. A third example was more of a *"virtual"* concept – the series of Regional Climate Outlook Forums, in particular those with active involvement and support from decision and policy makers (e.g., the Central American Climate Outlook Forum and its role within the Central American System for Integration). Regardless of the structure, workshop participants largely agreed that the creation of these boundary institutions and integration functions are critical to realizing previous and ongoing investments in climate science and services development.

B. Multi-disciplinary Decision Support Research as an Integral Component of International Climate Services

International climate services should include mechanisms to conduct, draw from or (where needed) foster and initiate research focused on the interactions of climate and society, including the multi-disciplinary study of impacts and vulnerability, and assessments that include a dialogue with stakeholders, and the identification of potential risk management and adaptation strategies. Over the course of the workshop, the following benefits were raised supporting the need for a continued and more targeted investment in multi-disciplinary decision support research (including the social sciences):

- Providing the "local" contextual knowledge necessary for climate information to be useful in practical risk management and adaptation efforts; "top down" information needs to be integrated with local priorities and processes for managing risk and change.

- Understanding how decisions are made and how different people, regions and sectors interpret and cope with uncertainty is helpful in developing, and communicating the limitations, of climate information.

- Decision support research, strengthened by cross-disciplinary collaboration, can help focus on the information and solutions needed for specific climate-related risk management challenges; this type of research can help unearth potential strategies for effectively developing services and products, enlisting these as part of a broad and inclusive approach to solving a problem, as well as provide feedback to the scientific research community.

- The study of economic impacts of action (and inaction) related to the use of climate information can create a better understanding of the need for investments in capacity and service development.

[4] The center is supported by a help desk established specifically for this purpose at the NOAA-supported IRI that involves embedding an individual from the Red Cross/Red Crescent in the IRI.

- The last twenty years of international climate services development could be characterized, in part, as "learning by doing" – of testing and responding to different products, processes and structures for conducting climate science and linking it in a practical sense to real world risk management challenges. Studying previous and ongoing projects and outcomes of this global scale "experiment" with an eye toward understanding what works and what doesn't is an important step in building effective, more systematic services for the future.

Another important research area relates to understanding and predicting climate and its impacts on longer timescales. Many workshop participants pointed out that a large percentage of risk management decisions are happening on a shorter-time scale, from seasons to years. There is useable scientific skill and products available on these time scales in some areas of the world, which can provide information to decision makers about historical, current and tomorrow's climatic conditions for some parameters (e.g., temperature and precipitation). However, decision makers appear to be increasingly interested in knowledge about periods on the 10-30 year timescale, which is currently a growing area of research. The further out the projection (of the climate, as well as of the other physical and socio-economic variables considered in a decision support mode) – the more challenging the scientific and communications task can become. Developing an enhanced predictive understanding of the multi-decadal timescale is important area of research for continuation in the next generation of international climate services development.

Partnerships and cross-institutional collaboration are key tools for achieving multi-disciplinary decision support research, given a) limited resources on the parts of many agencies and organizations; and, perhaps more importantly, b) the ubiquitous challenges related to climate change and variability that call for a range of knowledge and expertise that can rarely be found in any one entity. Several participants supported the concept of co-locating researchers focused on user needs (including context and capabilities) with the climate researchers actually doing the physical science research and modeling in order to facilitate the transfer and communication of user needs quickly and efficiently back to the research endeavor. Other models discussed included distributing some of the more basic research functions (in both the physical and social sciences) over a suite of agencies and programs, who would work in close collaboration with a center that serves as a boundary function, charged with integrating relevant research results, developing and evaluating decision support tools, capacity building, and feeding back their experiences to the research and service management communities.

C. Partnerships and International Climate Services

The challenges associated with understanding and incorporating knowledge regarding climate variability and change in climate-sensitive sectors and regions extend beyond the scope and mandate of any one entity. Thus, the creation and sustainability of efficient, climate services is highly dependent on targeted partnerships that span the continuum of activities involved in the production, dissemination, application, and evaluation of climate information for the benefit of society.

One of the panel discussants used the example of "information and decision chains" to illustrate the numerous components/elements potentially involved in the process of developing and translating climate information into the capabilities, decision support products and services that effectively reflect - and inform – climate-sensitive decision making. For example, if the targeted "end user" of climate information falls within the agricultural sector in a particular country or region, there are likely to be multiple institutions and "entry points" where climate insights and specific products could be co-developed and infused, including regional research networks and centers, the National Meteorological and Hydrological Services (NMHS), and extension agencies. Understanding these information chains, identifying key entry points, and working within them to bring climate science to bear on risk management involves partnerships among a suite of institutions that span the scientific and decision making realms.

Workshop participants encouraged partnership development with existing and emerging regional centers and networks, such as the Regional Climate Outlook Forums and those potentially developing under the umbrella of the emerging Global Framework for Climate Services (GFCS).

D. Training and Capacity Building

The ultimate effectiveness of international climate services in societal terms is, in part, determined by the ability of various actors in the system to participate in the development and utilization of decision support tools and systems. Currently, there is substantial international training and capacity building underway, but it is unlikely to fill all of the current gaps and demand. In many cases, what does exist needs to be better coordinated in order to achieve a maximum impact. Capacity building should be thought of from many different perspectives, including the more traditional training of researchers and forecasters with the universities and NMHSs, but also basic climate and adaptation awareness building and training for the media, educators, museum curators and the general public. In some cases, the international community might want to explore newer approaches facilitated by recent advances in technology, including webinars, chats, etc.

Workshop participants noted that a significant investment of time, energy and resources is needed to make long-term improvements in capacity. Recognizing resource limitations, the concept of "training the trainer" was suggested, as well as focusing on regional networks that can facilitate multinational collaboration and capacity building. Other approaches that have proven successful include internships, fellowships and employment programs that embed experts in one field (e.g., disaster preparedness, human health) in the institution of another (e.g., climate research and service). Finally, it was suggested that leaders in the field of climate research, services and applications for risk management and adaptation develop a set of "best practices" that can be utilized in capacity building across the spectrum of climate services efforts.

E. Prioritization, Assessment, and Evaluation of International Climate Services

As underscored throughout the workshop, the types of climate-related information needed for specific temporal and spatial timescales, sectors and decision types vary greatly (e.g., humanitarian assistance, national security, long-term economic growth, public health). That this increasing urgency and scope of demand is occurring in a resource-limited funding environment, creates an imperative for entities such as NOAA and others involved in climate services to prioritize their investments in research and climate services development[5]. The workshop participants discussed the importance of connecting research, applications and capacity building activities with region- and/or sector-based societal priorities and needs. Within this framework, international climate services efforts and the participating agencies need to develop effective strategies for understanding, monitoring and responding to these priorities.

Once regional priorities are identified, one approach to further hone in on specific needs is to think in terms of the "information and decision chains" discussed in an earlier section – identifying where some focused training/capacity building or information product would make the biggest impact on the quality of the outcome. Another of the approaches to prioritizing decision support research and climate services utilized by NOAA over the last ten years has been to focus on a combination of longer-term regional institution/capacity building and shorter-term, sector-specific research projects. This has allowed NOAA to make longer term investments in capacity in a given place, while also providing the flexibility needed to address specific, emerging issues within priority sectors.

In terms of assessing the impact of capacity building and decision support capabilities within the international climate services community, there were several approaches mentioned, but it is clear that long-term monitoring, assessment and interpretation of activities remains an important challenge for the future.

One of the challenges identified by participants in the area of communications regarding climate information and impacts is the notion that climate is static, with some minor variations on shorter-time scales that require some "fine-tuning" of decisions. Working with decision makers to understand that climate is an increasingly changing and important variable, and creating a space for this dialogue and the creation of spaces for exploring scenarios (which include information generated by socio-economic scenarios and other environmental changes) is an important function of international climate services. Finally, there is an assumption on the part of some decision makers that climate information is similar to that which they are used to receiving about weather, just on longer time scales. Communicating the uncertainty associated with climate knowledge and specific products is critically important.

Many of the workshop participants expressed concern about the challenge of evaluating the impact of their activities in a quantitative and meaningful fashion. In fact, defining what "impact" is (or should be) is a challenging first step. While there are anecdotal

[5] Workshop participants noted that prioritization includes deciding what *not* to do, as well as what *to* do.

accounts and expressions of support for existing climate services development activities, many institutions struggle with how to systematically conduct assessments of their activities and their impacts on various aspects of risk management. Workshop participants suggested that there should be an effort made to develop specific indicators to monitor and evaluate the effectiveness of climate services.

F. International Cooperation in Data Sharing, and Service and Product "Certification"

Workshop participants identified the challenges related to data sharing and product "certification" in the development of international climate services. As has been discussed in many international venues (e.g., the World Meteorological Organization), some countries are more willing to share weather data than climate data. This issue will need to be addressed.

The second issue – service and product certification - introduced several different dimensions and perspectives to the workshop dialogue. With an expanding demand and interest in climate information, there are many entities (some of which are part of the international climate community, and others, including private sector organizations, who are new to the field) that are and will be producing climate information products. This inevitable development is likely to result in non-trivial questions regarding the quality and accuracy of the available information. While there are many things that can affect the ultimate impact of using climate information (including socio-economic, political, and communications factors), the quality of the service or information product used is certainly an important variable. Some participants felt that NOAA could and should produce a certified service or product as part of its contribution to international climate services, but others felt that this approach may be contradictory to the approach of "co-development" described above (i.e., if the product is generated through a cooperative process, as opposed to more independently "issued" by an "authoritative source", it is more likely to be appropriately tailored to and accepted by the user community). In addition, NOAA could certify its own products and services, but does not have the resources to analyze and certify other information products on an international scale. It can, however, encourage international services and products providers to thoughtfully develop products where its inherent uncertainties and the limitations of its use are well articulated. This issue should be further developed within the international community, including through the GFCS dialogue.

III. Considerations for the Next Generation of NOAA's International Climate Services for Risk Management, Adaptation and Development

Based on the insights and discussions generated by the workshop, the following are some suggestions for NOAA to consider as it moves forward with the next generation of international climate services research and development:

1. *Focus NOAA's leadership role on the development and provision of climate information and applications in support of economically and ecologically sustainable growth through partnerships, including those with boundary organizations*

NOAA should continue to foster and support the development of boundary organizations and functions, with an emphasis on our key mission areas (water resources, coasts, marine ecosystems, climate and weather extremes), to advance the integration of climate information and applications development. Given the agency's global leadership in climate observations, models, multi-disciplinary decision support research and services, it is in a prime position to foster and influence the provision of services at the international level. Specifically, NOAA should continue to utilize its scientific and technical legitimacy, as well as its international and national experiences to help shape and create an international infrastructure (e.g., the Global Framework for Climate Services) that ensures the effective integration of partners at various scales (e.g., local, national, regional and international) and the productive interaction with decision makers. NOAA should continue to foster data sharing at the international level and consider leading the development of a framework for best practices for the development and use of particular decision support products.

NOAA should continue to play a leadership role in international climate services research and development, with an emphasis on applications for risk management and adaptation. NOAA should continue to develop and sustain research and applications partnerships to understand and respond to the needs of international and regional organizations and institutions associated with development, disaster response and human well-being (e.g., the World Bank, the regional development banks, the World Health Organization, the International Federation of the Red Cross/Red Crescent Societies, the Millennium Challenge Corporation).

2. *Develop a NOAA –wide integrated strategic plan for international climate services research and development that utilizes existing and evolving capabilities within the agency*

NOAA should advance the development of an agency-wide strategy for more effectively coordinating and integrating its activities related to international climate services research and development. This strategy should build on NOAA's strengths and capacities in the areas of international training, capacity building, modeling, observations, research, and the development of applications to improve societal climate resilience in key sectors and regions. It would build on the challenges and opportunities discussed at the September 2010 workshop focused on understanding and responding to user needs, but would identify specific areas and activities for enhanced collaboration among NOAA's in-house and external capabilities.

3. *Develop supportive partnerships with US government agencies and others that can use climate information to achieve their missions*

NOAA should enhance its focus on helping US government agencies that need climate information to achieve their missions in key sectors (e.g., humanitarian aid, disaster preparedness and response, national security). In order to do so, NOAA and its partners need to understand the missions, context and decision support needs of these other organizations, and help support them by providing information, technical support, data and model outputs. NOAA should strive to work closely with these agencies in a "co-discovery", iterative process in order to generate tools and information that help set - and respond to – "demand signals", and to help develop trust and an understanding of the limitations of climate data and projections on the part of the user. NOAA should convene several small group discussions with agencies that have expressed an interest in partnering with NOAA (perhaps in topic-specific Tiger Teams) to explore their needs and interests in greater detail (e.g., USAID), and consider expanding the recent inter-agency international adaptation inventory conducted by NOAA to include aspects related to the production and application of climate information in the context of adaptation and development challenges.

4. Develop new and innovative mechanisms to better understand, articulate and integrate NOAA's international research and experiences in climate services in its US efforts, and vice-versa, on a systematic basis

NOAA should develop mechanisms to monitor, analyze and evaluate its past and ongoing investments in international climate service development activities in a systematic fashion, in order to generate the following: 1) Ongoing "ground-truthing", and an understanding of NOAA's impact on the *development* and *use* of international climate services for risk management and adaptation; 2) Insight and "best practices" relevant to building, sustaining and applying effective climate services that can be utilized to inform risk management; and 3) Feedback from user communities regarding their needs and capabilities to utilize existing climate products, priorities and useful approaches, through partnerships.